IV. "The Electromotive Properties of the Electrical Organ of *Torpedo marmorata.*" By FRANCIS GOTCH, B.A., B.Sc. London, M.A. Oxon. Communicated by Professor BURDON SANDERSON, F.R.S. Received May 5, 1887.

(Abstract.)

After an introduction, in which the author sets forth the present state of knowledge with reference to the electromotive properties of the electrical organ of Torpedo, he gives an account of his own experimental investigations in three sections.

The first section relates to the nature of the changes produced in the electrical organ by mechanical injury and by heat, and the relation of these changes to those which manifest themselves under similar conditions in muscle and nerve, a subject which has not hitherto been inquired into.

In the second, the duration and the character of the response of the electrical organ to stimulation of its nerve are investigated for the first time by means of the rheotome and galvanometer.

In the experiments which are recorded in the third section, the author has entered on the examination of the after-effects which are produced in the organ by the passage through it of voltaic or induction currents, a subject which has been recently investigated by du Bois-Reymond.

The author is led by his experiments to believe that the physiological effects produced in the organ by injury, by the passage of currents, and by the stimulation of the electrical nerve, are, notwithstanding that they differ so widely from each other in distribution, duration, and intensity, all phenomena of excitation.

V. "On Thermal Radiation in Absolute Measure." By J. T. BOTTOMLEY, M.A. Communicated by Sir W. THOMSON, Knt., F.R.S. Received April 23, 1887.

(Abstract)

The investigation, of which a detailed account is given in the paper, was commenced in 1883, and some preliminary results were communicated to the Royal Society in June, 1884.

The radiating body used up to the present time has been a metallic wire;* and the general method of experimenting consists in keeping

* I propose, however, as soon as may be, to repeat and extend the experiment of D. Macfarlane ('Roy. Soc. Proc.' vol. 20, 1872) on radiation from metallic globes.

the wire heated by an electric current, and determining in absolute measure the electric energy necessary for this purpose. This energy is lost in radiation and in conduction at the ends, but chiefly in radiation. The wire is contained in a long copper tube, blackened inside, and kept cool by a water jacket; and the surface of the wire may be bright and polished, or may be modified by being coated with lamp-black, platinum-black, oxide of copper, or some other material. Polished wires have been chiefly used hitherto; but arrangements for comparison of wires with surfaces differently prepared are described in the paper.

Two methods of determining the electric energy have been used. One consists in measuring the electric current and the difference of potentials between chosen points in the radiation-wire; the other in measuring the current and determining simultaneously the electric resistance, by means of a Wheatstone bridge, modified to suit the necessities of the case.

A knowledge of the resistance of the radiation-wire gives also its temperature, by means of separate determinations (described in the paper) of the law of alteration of electric resistance with temperature. The temperatures of the radiation-wire and of the envelope are all referred to the air thermometer.

In order to vary the air-pressure surrounding the radiation-wire, and thus obtain data for the purpose of eliminating the heat-carrying properties of the air or other gas, the copper tube is connected, in a manner described in the paper, with a five-fall Sprengel pump; and the pressures in the extreme vacuums are measured by the M'Leod gauge.

The results of the investigation, so far as it has gone, are shown in a series of tables and curves.

A long and very complete series of determinations has been made of the radiation at various given constant pressures, but at different gradually increasing temperatures.

By means of curves of this kind, showing radiation in extreme vacuum, a comparison may be made between the results of experiment and the results calculated from Stefan's well-known fourth power law. The experimental results do not appear to give any support to that law.

Several series of determinations have been made at different constant temperatures, the pressure being continuously diminished. This mode of experimenting, by far the most appropriate to the purpose in hand, has only recently become convenient to the author, as it requires a special suitable current galvanometer. Further experiments are to be carried out with this method.

In the meantime it may be said that on continuously diminishing, by means of the Sprengel pump, the air surrounding the wire, a point

has been reached where further exhaustion does not affect the radiation observed. In this way a condition seems to be reached asymptotically, in which the radiation is independent of anything removable by the Sprengel pump. The value of the radiation found is, for the particular bright platinum wire used:—

At 408° C. ...... $378 \cdot 8 \times 10^{-4}$ gram water centigrade units per square centim. per sec.

„ 505° C. ...... $726 \cdot 1 \times 10^{-4}$ gram water centigrade units per square centim. per sec.

the temperature of the envelope being about 15° C.

Comparatively little has been done up to the present as to radiation from the same body with the surface in different conditions. The important results of Mr. Mortimer Evans, 'Roy. Soc. Proc.,' 1886, as to the energy required to maintain a given candle power in incandescent lamps, with dull and with polished filaments, have been confirmed. It is proposed to carry out further experiments on the influence of the surface of radiating bodies.

VI. "On Figures of Equilibrium of Rotating Masses of Fluid." By G. H. DARWIN, M.A., LL.D., F.R.S., Fellow of Trinity College and Plumian Professor in the University of Cambridge. Received April 28, 1887.

(Abstract.)

The intention of this paper is, first, to investigate the forms which two masses of fluid assume when they revolve in close proximity about one another, without relative motion of their parts; and secondly, to obtain a representation of the single form of equilibrium which must exist when the two masses approach so near to one another as just to coalesce into a single mass.

When the two masses are far apart the solution of the problem is simply that of the equilibrium theory of the tides. Each mass may, as far as the action on the other is concerned, be treated as spherical. When they are brought nearer to one another this approximation ceases to be sufficient, and the departure from sphericity of each mass begins to exercise a sensible deforming influence on the other.

The actual figure assumed by either mass may be regarded as a deformation due to the influence of the other considered as a sphere, on which is superposed the sum of an infinite series of deformations of each due to the deformation of the other and of itself.

But each mass is deformed, not only by the tidal action of the other, but also by its own rotation about an axis perpendicular to its